आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

SCHOOL OF AGRICULTURAL SCIENCES & ENGINEERING

DEPARTMENT OF AGRICULTURAL ENGINEERING

MASTER OF TECHNOLOGY
AGRICULTURAL ENGINEERING

[*w.e.f.* ACADEMIC SESSION 2021 – 22]

IFTM UNIVERSITY, MORADABAD
N.H.-24, Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh-244102
Website: www.iftmuniversity.ac.in

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Registrar
IFTM University
Moradabad

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SCHOOL OF AGRICULTURAL SCIENCES & ENGINEERING

DEPARTMENT OF AGRICULTURAL ENGINEERING

CBCS Based Course Structure and Syllabi

of

MASTER OF TECHNOLOGY
Agricultural Engineering

Soil and Water Conservation Engineering

[*w.e.f.* Academic Session 2021 – 22]

(As per CBCS guidelines given by UGC)

Summary

Programme	**: Master of Technology Agricultural Engineering**
Programme Level	**: Degree (Post Graduation)**
Duration	**: Two Years (Four Semesters) Full time**
Medium of Instruction	**: English**
Minimum Required Attendance	**: 75%**
Maximum Credits	**: 66**

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ORDINANCE

Eligibility Criteria for Admission:

(a) M. Tech. Agricultural Engineering (Farm Machinery & Power Engineering)

The candidates possess minimum 55% (50% for SC/ST) in B. Tech. Agricultural Engineering / B. Tech. Mechanical Engineering for admission.

(b) M. Tech. Agricultural Engineering (Soil and Water Conservation Engineering)

The candidates possess minimum 55% (50% for SC/ST) in B. Tech. Agricultural Engineering / B. Tech. Civil Engineering for admission.

(c) M. Tech. Agricultural Engineering (Process and Food Engineering)

The candidates possess minimum 55% (50% for SC/ST) in B. Tech. Agricultural Engineering / B. Tech. Biotechnology for admission.

Examination:

Question Paper Structure:

There will be 10 descriptive type questions out of which 5 question have to be attempt. Each question carries 14 marks.

Evaluation and Assessment:

<table>
<tr><th colspan="6">Assessment:</th></tr>
<tr><th colspan="3">Evaluation</th><th>Internal</th><th>External</th><th>Total</th></tr>
<tr><td colspan="3">Theory</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="3">Practical/ Project Reports/ Viva-Voce</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Class Test-1</td><td>Class Test-2</td><td>Class Test-3</td><td rowspan="2">Assignment(s)</td><td rowspan="2">Attendance & Participation</td><td rowspan="2">Total</td></tr>
<tr><td colspan="3">Best two out of three</td></tr>
<tr><td>10</td><td>10</td><td>10</td><td>5</td><td>5</td><td>30</td></tr>
<tr><td colspan="3" rowspan="2">Duration of Examination</td><td>Internal</td><td colspan="2">External</td></tr>
<tr><td>1 Hour</td><td colspan="2">3 Hours</td></tr>
</table>

Grade:

a) The minimum Grade required to pass in each Theory & Practical paper is 'GRADE D'.

i) A candidate, in order to pass have to obtain minimum CGPA of 4.50 is required in a particular academic year inclusive of both semesters of that academic year subject to conditions of carry over system.

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*Grade, Semester Grade Point Average (SGPA), Cumulative Grade Point Average (CGPA) , Final CGPA and Percentage equivalence of CGPA/ Final CGPA will be awarded as per University norms.

Carry Over System: The student will be permitted maximum 04 carry over papers included theory/ practicals/projects for promotion to next academic year.

***All the following will be governed as per university norms and regulations.**

i) Promotion,
ii) Change of grade already awarded,
iii) Award of division,
iv) Unfair means,
v) Results,
vi) Improvement,
vii) Grade card,
viii) Ex- studentship,
ix) Re- admission,
x) Convocation

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CHOICE BASED CREDIT SYSTEM (CBCS)

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Group of CBCS:

05 Groups of courses have been identified to provide students comprehensive exposure to a large number of areas, leading to the holistic development of an individual. These groups / clusters are as follows:

1. Engineering Core Courses (ECC)
2. Engineering Laboratory Courses (ELC)
3. Engineering Departmental Elective(EDE)
4. Engineering Supporting Courses (ESC)
5. Project/Dissertation/Seminar/Industrial training/General proficiency (PDT)

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M. Tech. Agricultural Engineering (Process and Food Engineering)			
Basic Structure: Distribution of Courses			
S. No.	**Type of Course**	**Credit**	**Total Credits**
1.	**Engineering Core courses (ECC)**	06 Courses of 3 Credits each (Total Credit 06X3)	18
2.	**Engineering Laboratory Courses (ELC)**	05 Courses of 1 Credits each (Total Credit 05X1)	05
3.	**Engineering Departmental Elective (EDE)**	02 Courses of 3 Credits each (Total Credit 2X3)	06
4.	**Engineering Supporting Courses (ESC)**	03 Courses of 3 Credits (Total Credit 03X3)	09
5.	**Project/Dissertation/ Colloquium (PDT)**	02 Course of 4 Credit (Total Credit 04X2) 01 Course of 20 Credits (Total credit 01x20)	28
Total Credits			**66**

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M. Tech. Agricultural Engineering (Soil and Water Conservation Engineering)			
Basic Structure: Distribution of Courses			
S. No.	**Type of Course**	**Credit**	**Total Credits**
1.	**Engineering Core courses (ECC)**	07 Courses of 3 Credits each (Total Credit 07X3)	21
2.	**Engineering Laboratory Courses (ELC)**	05 Courses of 1 Credits each (Total Credit 05X1)	05
3.	**Engineering Departmental Elective (EDE)**	03 Courses of 3 Credits each (Total Credit 3X3)	09
4.	**Engineering Supporting Courses (ESC)**	01 Courses of 3 Credits (Total Credit 1X3)	03
5.	**Project/Dissertation/ Colloquium (PDT)**	02 Course of 4 Credit (Total Credit 04X2) 01 Course of 20 Credits (Total credit 01x20)	28
Total Credits			**66**

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M. TECH. AGRICULTURAL ENGINEERING (SWCE)
CHOICE BASED CREDIT SYSTEM
Effective from Session 2021-22

Course Code	CBCS BASKET	Credits			
Engineering/Discipline/Professional Core Courses(ECC)		**L**	**T**	**P**	**C**
MSWE101	Watershed Hydrology	2	1	0	3
MSWE102	Water Quality and Environment	2	1	0	3
MSWE103	Soil and Water Conservation Engineering	2	1	0	3
MSWE201	Open Channel Flow	2	1	0	3
MSWE202	Planning and Management of Watershed	2	1	0	3
MSWE301	GIS and Remote Sensing for Land and Water Resources Management	2	1	0	3
MSWE302	Sediment Transport	2	1	0	3
Engineering Supporting Courses (ESC)					
MMAG204	Agricultural Statistics and Experimental Designs	2	1	0	3
Engineering Lab Course(ELC)		**L**	**T**	**P**	**C**
MSWE151	Watershed Hydrology Lab	0	0	2	1
MSWE152	Water Quality and Environment Lab	0	0	2	1
MSWE251	Open Channel Flow Lab	0	0	2	1
MMAG254	Agricultural Statistics and Experimental Designs Lab	0	0	2	1
MSWE351	GIS and Remote Sensing for Land and Water Resources Management Lab	0	0	2	1
Engineering Departmental Elective (EDE)		**L**	**T**	**P**	**C**
Elective-I	MSWE104 A Ground Water Engineering	2	1	0	3
	MSWE104 B Design of Pumps for Irrigation and Drainage				
Elective-II	MSWE203 A Design of Farm Irrigation Systems	2	1	0	3
	MSWE203 B Flow through Porous Media				
Elective-III	MSWE303 A Crop Environmental Engineering	2	1	0	3
	MSWE303 B Design of Surface Irrigation System				
Project/Dissertation/Seminar/Summer or Industrial Training (PDT)		**L**	**T**	**P**	**C**
MSWE352	Seminar	0	0	4	4
MSWE353	Pre-Dissertation	0	0	4	4
MSWE451	Dissertation Work			20	20

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STUDY & EVALUATION SCHEME

M. Tech. Agricultural Engineering (Soil &Water Conservation Engineering)

Effective From Session 2021-22

CHOICE BASED CREDIT SYSTEM (CBCS)

YEAR I, SEMESTER- I

S.N.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
							Mid Term Exam			External Exam		
				L	T	P	CT	AS +AT	Total			
THEORY												
1.	ECC	MSWE101	Watershed Hydrology	3	0	0	20	10	30	70	100	3
2.	ECC	MSWE102	Water Quality and Environment	3	0	0	20	10	30	70	100	3
3.	ECC	MSWE103	Soil and Water Conservation Engineering	3	0	0	20	10	30	70	100	3
4.	EDE	MSWE104	Elective I	3	0	0	20	10	30	70	100	3
PRACTICALS / PROJECT												
							IA	AT				
5.	ELC	MSWE151	Watershed Hydrology Lab	0	0	2	20	10	30	70	100	1
6.	ELC	MSWE152	Water Quality and Environment Lab	0	0	2	20	10	30	70	100	1
.			**TOTAL**	**12**	**00**	**04**					**600**	**14**

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STUDY & EVALUATION SCHEME

M. Tech. Agricultural Engineering (Soil &Water Conservation Engineering)

Effective From Session 2021-22

CHOICE BASED CREDIT SYSTEM (CBCS)

YEAR I, SEMESTER- II

S.N.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
							Mid Term Exam			External Exam		
				L	T	P	CT	AS +AT	Total			
THEORY												
1.	ECC	MSWE201	Open Channel Flow	3	0	0	20	10	30	70	100	3
2.	ECC	MSWE202	Planning and Management of Watershed	3	0	0	20	10	30	70	100	3
3.	ESC	MMAG204	Agricultural Statistics and Experimental Designs	3	0	0	20	10	30	70	100	3
4.	EDE	MSWE203	Elective II	3	0	0	20	10	30	70	100	3
PRACTICALS / PROJECT												
							IA	AT				
5.	ELC	MSWE251	Open Channel Flow Lab	0	0	2	20	10	30	70	100	1
6.	ELC	MMAG254	Agricultural Statistics and Experimental Designs Lab	0	0	2	20	10	30	70	100	1

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STUDY & EVALUATION SCHEME

M. Tech. Agricultural Engineering (Soil &Water Conservation Engineering)

Effective From Session 2021-22

CHOICE BASED CREDIT SYSTEM (CBCS)

			TOTAL	**12**	**00**	**04**					**600**	**14**

YEAR II, SEMESTER- III

S.N.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
							Mid Term Exam			External Exam		
				L	T	P	CT	AS +AT	Total			
THEORY												
1.	ECC	MSWE301	GIS and Remote Sensing for Land and Water Resources Management	3	0	0	20	10	30	70	100	3
2.	ECC	MSWE302	Sediment Transport	3	0	0	20	10	30	70	100	3
3.	EDE	MSWE303	Elective III	3	0	0	20	10	30	70	100	3
PRACTICALS / PROJECT												
							IA	AT				
4.	ELC	MSWE351	GIS and Remote Sensing for Land and Water Resources Management Lab	0	0	2	20	10	30	70	100	1
5.	PDT	MSWE 352	Seminar	0	0	4	-	100	100	-	100	4
6.	PDT	MSWE 353	Pre-Dissertation	0	0	4	-	-	50	50	100	4

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STUDY & EVALUATION SCHEME

M. Tech. Agricultural Engineering (Soil &Water Conservation Engineering)

Effective From Session 2021-22

CHOICE BASED CREDIT SYSTEM (CBCS)

			Total	**09**	**0 0**	**10**					**600**	**18**

YEAR II, SEMESTER- IV

S.N.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
							Mid Term Exam			External Exam		
				L	T	P	CT	AS +AT	Total			
PRACTICALS / PROJECT												
1.	**PDT**	MSWE451	**Dissertation Work**	-	-	20		300	300	300	600	20
			Total	-	-	**20**					**600**	**20**

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STUDY & EVALUATION SCHEME

M. Tech. Agricultural Engineering (Soil &Water Conservation Engineering)

Effective From Session 2021-22

CHOICE BASED CREDIT SYSTEM (CBCS)

Engineering Departmental Elective (EDE)		
Elective-I	MSWE104 A	Ground Water Engineering
	MSWE104 B	Design of Pumps for Irrigation and Drainage
Elective-II	MSWE203 A	Design of Farm Irrigation Systems
	MSWE203 B	Flow through Porous Media
Elective-III	MSWE303 A	Crop Environmental Engineering
	MSWE303 B	Design of Surface Irrigation System

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MSWE101 **Watershed Hydrology** **L:T:P 3:0:0**

Objectives:

- To familiarize the students with the important aspects of watershed hydrology.
- To impart the knowledge about the various hydrologic phenomena and their relevance in the field of soil and water conservation.
- The main aim of watershed management is to conserve the soil, plant, and water resources of a catchment while benefiting humanity. All environmental, social, and economic concerns are combined to treat watersheds in an integrated manner.

UNIT I

Hydrologic processes and systems, Hydrologic problems of small watersheds, Hydrologic and geomorphologic characteristics of watersheds **for skill enhancement**.

UNIT II

Measurement and analysis of hydrologic parameters, rainfall-runoff models, and stream flow measurement and analysis of data **for better skilling of entrepreneurship**.

UNIT III

Hydrograph analysis, Unit hydrograph theory, Synthetic and dimensionless hydrograph, IUH, convolution of unit hydrograph **for better employability in industry**.

UNIT IV

Concept of hydraulic flood routing, flood routing (reservoir and channel routing) **methods for skilling of rescue management.**

UNIT V

Definition and concept of different types of hydrologic models for simulation of hydrologic problems **for skill development and employability**.

Course Outcomes:

At the end of the course, the students will be able to:

CO1: Understand the components of hydrologic cycle and their importance **for skill enhancement.**

CO2: Compute the Hydrologic parameters and its analysis **for better skilling of entrepreneurship**.

CO3: Understand the concept of hydrograph and its analysis **for better employability in industry.**

CO4: Understand the concept of flood routing and routing methods **for skilling of rescue management**.

CO5: Understand the hydrological models and its simulation **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

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Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	2	1	2	1	1	1	3
CO:2	1	3	2	1	1	3	1	2
CO:3	2	1	2	1	1	1	2	1
CO:4	1	1	3	3	1	1	3	1
CO:5	1	1	2	2	3	2	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	1	1
CO:2	3	2	3
CO:3	2	3	1
CO:4	3	2	2
CO:5	3	3	1

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

References:

1. Chow VT, David, M & Mays LW. 1988. Applied Hydrology. McGraw Hill.
2. Ghanshyan Das 2000. Hydrology and Soil Conservation Engineering. Prentice Hall.
3. Sigh, V.P. Elementary hydrology., Practice Hill of India Pvt. LTD. New Delhi
4. Subramanya, K. Engineering Hydrology. Tata McGraw-Hill Publishing Company Limited New Delhi

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- agrimoon.com
- http://ecoursesonline.iasri.res

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MSWE151 **Watershed Hydrology Lab** **L:T:P0:0:1**

List of Experiments:

Minimum 08 experiments out of the following:

1. Study of different types of rain gauges
2. Exercise on analysis of rainfall data
3. Geomorphologic characteristics of watershed.
4. Runoff computation
5. Construction of hydrograph
6. Hydrograph analysis
7. Exercise on flood routing problems
8. Hydrologic models
9. Study of stage recorders and current meters
10. Visit to watershed and dam sites.

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MSWE102 Water Quality and Environment L: T: P 3:0:0

Objective:

- To familiarize the water quality in relation to domestic, industrial and agricultural activities.
- To impart awareness of impurities which contaminated the surface and ground water and also give the awareness on its control and management measures.
- To introduce students to how the common environmental experiments relating to water and wastewater quality are performed.

UNIT I

Introduction to non-point and point source of pollution, basic causes of pollution, impact of pollution on environment, stream water quality, control of non-point source of pollution, utilization, recovery and recycling of solid and liquid wastes **for skill enhancement**.

UNIT II

Movement of pollutants in aquatic environment, water quality parameters, concepts and analysis impurities and water quality characterization, Physical, chemical and Biological parameters, analytical estimation **for better skilling of entrepreneurship**.

UNIT III

Effect of global warming and climatic change on soil and water quality, Analysis and interpretation of water quality data, statistical techniques for data analysis **for better employability in industry**.

UNIT IV

Analysis for correlations, variability, trends etc water quality modeling, mathematical modeling on pollution control, Water quality legislation and management, water quality criteria and standards **methods for skilling of rescue management.**

UNIT V

National and International perspective, surface and groundwater quality management, environment impact assessment, introduction to environment impact assessment – concept and methodologies, case studies **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

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CO1: know about the pollution and its effects on environment **for skill enhancement**.

CO2: Understand the water quality parameters and characteristics **for better skilling of entrepreneurship**.

CO3: Understand the climate change and its effects on soil and water quality and on agriculture **for better employability in industry**.

CO4: know about the water quality modeling and mathematical modeling on pollution control **methods for skilling of rescue management.**

CO5: Manage the surface and ground water quality using relevant models **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	1	1	3
CO:2	1	3	1	1	3	3	3	1
CO:3	1	3	1	1	1	1	3	3
CO:4	3	1	2	3	1	1	3	1
CO:5	3	1	3	1	3	1	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	2
CO:2	2	1	3
CO:3	1	3	1
CO:4	3	1	2
CO:5	3	3	1

References:

1. Robert A. Corbitt., San Francisco, Washington, D.C., Auckland Standard Handbook of Environmental Engineering, Second Edition,. McGraw-Hill Companies, Inc.
2. **Deng**, X., **Wang**, Y., **Wu**, F., **Zhang**, T., **Li**, Z. Integrated River Basin Management

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3. **Tjeerdema**, Ronald S. (Ed.), Aquatic Life Water Quality Criteria for Selected Pesticides

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MSWE152 **Water Quality and Environment Lab** **L:T:P 0:0:1**

List of Experiments:

1. Determination of pH, dissolved and suspended solids
2. Determination of chlorides and sulphates
3. Determination of turbidity and hardness
4. Determination of BOD and COD
5. Determination of Nitrogen (ammonical, nitrate, nitrite) and MPN
6. Determination of Total count of bacteria in water/ sewage samples
7. Estimation of chemical amendments to maintain qualities of soil and water

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MSWE103 Soil and Water Conservation Engineering L:T:P 3:0:0

Objectives:

To have understanding about the degradation of productive soil globally and its effect thereon, also to know about the causes about water scarcity and their solution to fight against the evil effects through soil and water conservation technologies.

UNIT I

Probability theory and distributions, planning of soil and water conservation measures **for skill enhancement**.

UNIT II

Design of soil and water conservation structures -contour bund, graded bund and terraces **for better skilling of entrepreneurship**.

UNIT III

Hydrologic jump and energy dissipation, gully control structures, check dams, Design of permanent soil conservation structures **for better employability in industry**.

UNIT IV

Earthen dams, seepage through dams and stability analysis **methods for skilling of rescue management.**

UNIT V

Water harvesting and recycling, flood control and stream bank protection **for skill development and employability**.

Course Outcomes:

The student will be able to:

CO1: Know about the soil and water conservation measures and probability distribution methods **for better skilling of entrepreneurship**.

CO2: Understand the design of soil and water conservation structures.

CO3: Understand the concept of hydraulic jump and gully control structures that can be undertaken **for better employability in industry**.

CO4: Understand the earthen dam relevance and its design **methods for skilling of rescue management.**

CO5: understand the water harvesting techniques and flood and stream bank erosion control **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	2	1	3
CO:2	1	3	3	2	1	2	2	2
CO:3	2	1	3	1	2	3	3	3
CO:4	3	2	3	3	1	3	3	1
CO:5	3	2	3	2	3	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	2	1	3
CO:2	1	2	1
CO:3	2	3	2
CO:4	3	1	1
CO:5	3	3	2

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5. R.V. Singh:Watershed Planning and management, Yash. Publ.
6. Ghanshyam Das: Hydrology and Soil Conservation Engg-Including Watershed Management.

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MSWE201 **Open Channel Flow** **L:T:P 3:0:0**

Objective

- To develop a basic knowledge of open channel flow relationships by applying fluid properties, hydrostatics, and the conservation equations for mass, momentum, and energy
- Introduction to the basic concepts of free surface flows
- Description of the equations of varied flow and basic concepts of Fluvial Hydraulics

UNIT I

Open channel and their properties, Energy and momentum principles, Critical flow computations and applications **for skill enhancement**.

UNIT II

Uniform flow. Its development, Formula and design computation **for better skilling of entrepreneurship**.

UNIT III

Boundary layer concept. Surface roughness, Velocity distribution and instability of uniform flow **for better employability in industry**.

UNIT IV

Gradually varied flow theory and analysis, Method of computations **methods for skilling of rescue management.**

UNIT V

Hydraulic jump and its use as leveling energy dissipation, Spatially varied flow, Unsteady flow. Rapidly varied flow **for skill development and employability**.

Course Outcomes:

On completion of this course, the students are expected to be able to:

CO1: Develop the common understanding of open channel flow and their properties as well as its application **for skill enhancement**.

CO2: Understand the concept and importance of uniform flow and its design computation **for better skilling of entrepreneurship**.

CO3: Know about the surface roughness and velocity distribution in uniform flow **for better employability in industry**.

CO4: Understand the concept of gradually varied flow **methods for skilling of rescue management.**

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CO5: Understand the relevance of hydraulic jump, rapidly varied flow and energy dissipation importance in any flow **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	2	3	3	1	1	3
CO:2	1	3	1	2	3	3	2	2
CO:3	2	1	3	1	2	2	3	3
CO:4	3	2	3	3	1	3	3	1
CO:5	3	1	3	1	3	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	1	2
CO:2	3	2	3
CO:3	1	3	1
CO:4	3	1	2
CO:5	3	3	1

References:

1. Henderson FM.1966. Open Channel Flow. Macmillan.
2. Subramaninum K,. 1960. Open Channel Flow. McGraw Hill.
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MSWE251 **Open Channel Flow Lab** **L:T:P 0:0:1**

List of Experiments:

1. Exercise on open channels and flow conditions.
2. Exercise on hydraulic jumps
3. Study of sub critical, critical and super critical regions.
4. Exercise on energy and momentum equations.
5. Study and characteristic of gradually varied flow (GVF).
6. Study and characteristic of Spatially varied flow (SVF).
7. Analysis of Critical flow computations.

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MSWE202 Planning and Management of Watershed L:T:P 3:0:0

Objectives

- To acquaint the students about the preparation of the detail report of the problems and causes related to the water, land, vegetation and social aspects of specific area and their remedies through watershed planning and management.
- The student will get a comprehensive idea about watershed management.
- The student will be capable of planning and execution of watershed management projects

UNIT I

Watershed - concept and management, types of watershed, watershed characteristics deterioration of watershed, land capability classification, watershed delineation, delineation of priority watershed, coding of watershed, analysis of watershed **for skill enhancement**.

UNIT II

Watershed management: factors affecting, site selection, watershed management practices, lanning of watershed works, guidelines for project preparation, formulation of project proposal for watershed management works, steps of watershed management **for better skilling of entrepreneurship**.

UNIT III

Evaluation and monitoring of watershed programmes, Hydrology of forest watersheds, hydrologic process affected, evaporation, transpiration, interception, infiltration and depression storage **for better employability in industry**.

UNIT IV

Hydrologic evaluation of land treatment, erosion and sedimentation in forest watersheds Agricultural watersheds, sodic saline watersheds, water logging, declining water table pesticides, and insecticide **methods for skilling of rescue management.**

UNIT V

Common guidlines for watershed development projects, Participatory watershed management case studies **for skill development and employability**.

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At the end of the course, the students will be able to-

CO1: Understand the meaning of watershed and its analysis and management techniques **for skill enhancement**.

CO2: Know the concept of watershed management and its associated projects **for better skilling of entrepreneurship**.

CO3: Evaluate and monitor watershed programs and other hydrologic parameter analysis **for better employability in industry**.

CO4: Understand the techniques involved in land treatment and erosion and sedimentation control **methods for skilling of rescue management.**

CO5: Analyze about the guidelines undertaken for watershed development projects and its management **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	2	1	3
CO:2	1	3	2	1	3	3	2	2
CO:3	2	1	3	1	1	1	3	3
CO:4	3	2	3	3	2	3	3	1
CO:5	3	2	3	2	3	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	3	1	3
CO:3	2	3	2
CO:4	3	2	1
CO:5	3	3	2

References:

1. Dhurvarayana,V.V Sastry,G,and U.S Patnaik. 1990. watershed Management. Indian

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Council of Agricultural Research. New Delhi

2. Raj vir singh. 2000. Watershed Planning and Management. yash Publishing House
3. Murthy VVN. 1998. Land and Water Management Engineering, Kalyani Publishers.
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MMAG 204 Agricultural Statistics and Experimental Design L:T:P : 3:0:0

Objective: The main aims of this course are to provide comprehensive knowledge of the basic information of agriculture statistics and experimental design.

Unit I

Presentation of Data: Frequency distributions; graphical presentation of data by histogram, frequency polygon, frequency curve and cumulative frequency curves Measures of Locations and Dispersion: Mean, median, mode and their simple properties (with-out derivation) and calculations of median by graphs; range, mean deviation, standard deviation, standard error, coefficient of variation **for skill enhancement**.

Unit II

Probability and Distributions: Random distributions; events exhaustive, mutually exclusive and equally likely; definition of probability (with simple exercises); definitions of binomial, Poisson's and normal distributions; and simple properties of the above distributions (without derivation) **for better skilling of entrepreneurship**.

Unit III

Correlation and Regression: Bivariate data-simple correlation and regression coefficients and their relation; Spearman rank correlation; limits of correlation coefficient; effect of change of origin and scale on correlation coefficient; linear regression and equations of line of regression; association and independence of attributes **for better employability in industry**.

Unit IV

Sampling: Concept of population and sample; random samples; methods of taking a simple random sample. Tests of significance: sampling distribution of mean and standard error; z and t-test (equality of means; paired and unpaired t-test); t-test for comparison of means when variances of two populations differ; Chi- square test for goodness of fit; independence of attributes, and homogeneity of samples; interrelation between t-test and F-Test **methods for skilling of rescue management.**

Unit V

Experimental Designs**:** Principles of experimental designs; completely randomized, randomized complete block design (missing plot value in RBD); latin square designs; augmented block design; simple factorial experiments including split and strip plot design

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(mathematical derivations not required); analysis of variance (ANOVA) and its use including estimation of LSD (CD) **for skill development and employability**.

Course Outcomes:

The student is able to

CO1: Understand basic theoretical and applied principles of agricultural statistics needed in agriculture **for skill enhancement**.

CO2: Demonstrate an understanding of the basic concepts of probability distributions and random variables **for better skilling of entrepreneurship**.

CO3:Understand the concepts of correlation and regression **for better employability in industry**.

CO4: Analyze the sampling methods and its importance for understanding the commodity markets and economic data **methods for skilling of rescue management.**

CO5: Know about the experimental design and its applications **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	1	3	3
CO:2	1	3	2	1	3	3	2	1
CO:3	3	2	3	2	2	1	1	3
CO:4	3	1	3	3	1	2	3	1
CO:5	3	2	3	1	3	3	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
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	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	3	1	3
CO:3	1	3	2
CO:4	3	2	1
CO:5	3	3	2

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1. J, Medhi: Statistical Methods, New age International (P) Ltd.
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5. M. Ray, Mathematical Statistics, R.P & Sons, Agra.
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MMAG 254 Agricultural Statistics and Experimental Design Lab L:T:P 0:0:1

List of Experiments:

1. Measurement of central tendency and dispersion
2. Standard deviation and standard error
3. Principle uses of χ_2, F and T- test.
4. Correlation Coefficient, Regression coefficient and Regression equation.
5. Analysis of data generated from completely randomized design, randomized block design.
6. Analysis of data generated from Latin square design, factorial experiments in 2^2, 2^3 Split plot designs
7. Missing plot techniques.
8. Analysis of covariance.
9. Sampling in field experiments.
10. Analysis of variance (ANOVA).

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MSWE 301 GIS and Remote Sensing for Land and Water Resources Management

L:T:P 3:0:0

Objectives

- To provide exposure to students in gaining knowledge on concepts and applications leading to modeling of earth resources management using Remote Sensing, GIS and GPS technologies.
- To acquire skills in storing, managing digital data for planning and development.
- To introduce the fundamentals of remote sensing and geographical information systems and to inculcate ability to apply principles and techniques of GIS and remote sensing in hydrology.

UNIT I

Basic principles of remote sensing and sensors. Elements of photogrammetry **for skill enhancement**.

UNIT II

Electromagnetic spectrum. Energy interaction with surface features Aerial photo and satellite imagery, Photo and image interpretation **for better skilling of entrepreneurship**.

UNIT III

Principles of Geographical Information System tools, their types and capabilities, Advantages of GIS over conventional methods **for better employability in industry**.

UNIT IV

Importance of ground truth establishment, GIS and remote sensing for land and water resources data collection, analysis and interpretation **methods for skilling of rescue management.**

UNIT V

Application of GIS in water and land resource development and management **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

CO1: Understanding the concept of remote sensing and photogrammetry **for skill enhancement**.

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CO2: Know about the electromagnetic spectrum, energy interaction and image interpretation **for better skilling of entrepreneurship**.

CO3: understand the concept of Geographical Information System tools **for better employability in industry**.

CO4: Analyze the GIS and remote sensing data for land and water resources development **methods for skilling of rescue management.**

CO5: Apply the concept of GIS for judicious land and water management **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	3	3	3	3	1	3
CO:2	1	3	2	1	3	3	2	1
CO:3	2	1	3	2	1	2	3	3
CO:4	3	2	1	3	2	3	3	2
CO:5	3	1	3	1	3	3	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	1	2
CO:2	3	2	3
CO:3	1	3	1
CO:4	3	1	2
CO:5	3	3	1

References:

1. De Mess M.N. 2004. Fundamental of Geographic Information System. John Wiley & Sons.
2. Lille Sand T & Kaiffer R.1987. Remote Sensing and Image Interpretation. John Wiley & Sons.
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MSWE351 GIS and Remote Sensing for Land and Water Resources Management Lab

L:T:P 0:0:1

List of Experiments:

1. Familiarization with remote sensing and GIS
2. GIS Software and their principle of working
3. Methods of establishing ground truth points,.
4. Comparison between ground truth and remotely sensed data.
5. Application of GIS packages.

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MSWE 302 **Sediment Transport** **L:T:P 3:0:0**

Objective:

The course is to provide the student with an water **flow** and stream **flow** analyses, erosion and **sedimentation**, fluvial

Unit I

Origin and formation of sediment; fundamental properties of individual sedimentary particles, bulk properties of sediment, incipient motion of sediment particles; competent velocity, lift concept critical tractive force **for skill enhancement**.

Unit II

Bed load transport and saltation, bed load equations, Total load transport, microscopic and macroscopic methods, Sediment yields from watersheds, factors affecting sediment yield, modeling and prediction of sediment yield, Musgrave equation **for better skilling of entrepreneurship**.

Unit III

Universal soil loss equation and, its application to agricultural watersheds, MUSLE etc, sediment delivery ratio method, factors affecting sediment delivery ratio, determination of sediment delivery ratio, Dendy -Bolton method, regression analysis **for better employability in industry**.

Unit IV

Runoff sediment relation, sediment concentration graph, unit sediment graph, instantaneous unit sediment graph, series graph, System models, unit impulse response, step response and unit pulse response functions and their application on sediment problems **methods for skilling of rescue management.**

Unit V

Sediment samplers and sampling, bed load sampling, suspended load sampling, sediment control measures **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

CO1: Able to estimate the sediment from the particular watershed by using various instruments **for skill enhancement**.

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CO2: To develop the common understanding of mechanics of sediment transportation process and remedies to reduce this **for better skilling of entrepreneurship**.

CO3: Able to analyze the soil loss and other associated parameters **for better employability in industry**.

CO4: Understand the runoff sediment relation using different types of graphs **methods for skilling of rescue management.**

CO5: Know about the sediment sampling methods for sediment control **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	2	1	3
CO:2	1	3	3	2	3	3	2	2
CO:3	2	1	3	1	2	3	3	3
CO:4	3	2	1	3	1	3	3	1
CO:5	3	1	3	2	3	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
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	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	1	1	3
CO:3	1	3	2
CO:4	3	1	1
CO:5	3	3	2

References:

1. R. J. Garde, K. G. Ranga Raj., Mechanics of Sediment Transportation & Alluvial Stream Problems, Willey Eastern Limited New Delhi.
2. Walter Hans Graf., Hydraulics of Sediment Transport. Water Resources publication. LLC.
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MSWE104 I **Ground Water Engineering** **L:T:P 3:0:0**

Objectives:

- A pathway to understand the basic physical principles of groundwater flow, differential equations, boundary condition and groundwater quality.
- Knowledge of various aspects of recharge of groundwater.
- Exposure to use the numerical solutions to solve problems with complex realistic situations.

UNIT I

Properties affecting groundwater storage and movement, groundwater balance Studies **for skill enhancement**.

UNIT II

Well hydraulics, two dimensional flow steady and unsteady state flow in confined, unconfined and semi-confined aquifers **for better skilling of entrepreneurship**.

UNIT III

Steady flow in sloping aquifers, partial penetrating wells, analysis of multi-aquifers, Flow analysis in interfering wells **for better employability in industry**.

UNIT IV

Pumping tests and determination of aquifer parameters, groundwater modeling for water resources planning **methods for skilling of rescue management.**

UNIT V

Techniques for groundwater recharge **for skill development and employability**.

Course Outcomes:

CO1: Understand about the groundwater storage and its properties **for skill enhancement**.

CO2: Understand the concept of well hydraulic, steady state and unsteady state flow **for better skilling of entrepreneurship**.

CO3: develop the methods for steady state flow analysis **for better employability in industry**.

CO4: understand the pumping tests that can be undertaken and study of aquifer parameters

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CO5: Undertsnd the techniques for groundwater recharge **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	2	3	3	1	2	3
CO:2	1	3	1	2	3	3	3	1
CO:3	2	1	3	1	2	1	1	3
CO:4	3	2	1	3	1	2	3	2
CO:5	3	1	3	1	3	3	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	1	2
CO:2	2	2	3
CO:3	1	3	1
CO:4	2	1	2
CO:5	3	3	1

References:

1. Todd DK. 1997. Ground Water Hydrology. Wiley Eastern.
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MSWE104 II Design of Pumps for Irrigation and Drainage L:T:P 3:0:0

Objectives:

- To acquaint students with the design and management of landscape irrigation systems
- To expose the students the various principles of irrigation methods
- To inculcate the different types of irrigation and drainage systems and their performance based on service oriented approach.

Unit I

Basic hydraulic design of centrifugal pump, water hammering problem in centrifugal pump **for skill enhancement**.

Unit II

Principle and performance characteristics of vertical turbine pump, submersible pump and axial flow pump and their design **for better skilling of entrepreneurship**.

Unit III

Non-conventional energy sources for pumping, wind mills, micro turbines, solar pumps **for better employability in industry**.

Unit IV

Hydraulic ram- their selection and design criteria **methods for skilling of rescue management.**

Unit V

Design of pumping station, techno-economic evaluation, Energy conservation measures for pumping systems **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

CO1: Understanding the functioning and design of centrifugal pumps **for skill enhancement**.

CO2: Understanding the functioning and design of vertical turbine pumps, submersible pumps and axial flow pumps.

CO3: develop knowledge about the Non-conventional energy sources for pumping **for better employability in industry**.

CO4: Analyze about the hydraulic ram design.

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CO5: design a pumping station with required specifications for any pumping system installation **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	1	2	3
CO:2	2	3	2	1	3	3	1	2
CO:3	3	1	3	2	1	2	3	3
CO:4	1	2	1	3	2	3	3	2
CO:5	3	1	3	1	3	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	2
CO:2	1	3	1
CO:3	2	3	2
CO:4	1	1	1
CO:5	3	3	2

References:

1. Church AH & Jagdish Lal 1973. Centrifugal Pumps and Blowers. Metropolitan Book Co.
2. Michael AM & Khepar SD. 1989. Water Well and Pump Engineering. Tata McGraw Hill.
3. Michael AM. 1990. Irrigation Theory and Practice. Vikas Publ. House.
4. Modi PN & Seth SM. 2000 Hydraulic and Fluid Mechanics. Standard Book House.

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MSWE104C - DRY-LAND WATER MANAGEMENT TECHNOLOGIES

Course objective

To provide detail knowledge about analysis of severity of drought assessment and various dry land water management technologies suitable for conservation, harvesting and enhancing productivity of rainfed areas.

Unit I

Drought severity assessment: Meteorological, hydrological and agricultural methods.Drought indices. GIS based drought information system, drought vulnerability assessment and mapping using GIS. DPAP, drought monitoring constraints, limiting crop production in dry land areas. Types of drought, characterization of environment for water availability, crop planning for erratic and aberrant weather conditions **for skill enhancement**

Unit II

Stress physiology and crop resistance to drought, adaptation of crop plants to drought, drought management strategies. Preparation of appropriate crop plans for dry land areas. Mid contingent plan for aberrant weather conditions **for better employability inindustry**

Unit III

Land shaping and land development for soil moisture conservation. Improvement of tillage and soil management by implements and engineering practices. Soil and moisture conservation for rainfed lands through improved implements and engineering practices. Gel technology.

Ex-situ measures: Water harvesting-micro catchments. Design of small water harvesting structures: Farm Ponds, percolation tanks their types and design, recycling of runoff water for crop productivity. **for better employability in industry**

Unit IV

Crops and cropping practices related to soil and moisture conservation. Fertility management in dryland farming. Planning and development of watersheds fromengineering view point. Case studies. **For better skilling of entrepreneurship**

Unit V

Application of aerial photography in surveys and planning of watersheds for rainfed agriculture. Use of Remote Sensing in soil moisture estimation. **For better skilling of entrepreneurship**

Outcomes

The students will be able to understand

CO1: drought severity assessment techniques **for skill enhancement**

CO2: new and appropriate methods of rainwater conservation **for better employability in industry**

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CO3: rainwater harvesting technologies for rainfed areas. **for better employability in industry**

CO4: Crops and cropping practices **For better skilling of entrepreneurship**

CO5: photography in surveys and planning **For better skilling of entrepreneurship**

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	2	3	2	3	2	1	3
CO:2	3	1	1	3	3	3	2	3
CO:3	1	2	3	3	3	1	3	3
CO:4	3	3	1	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	1	3	2
CO:3	2	3	1
CO:4	2	1	3
CO:5	2	1	3

Suggested Books:

- Das NR. 2007. *Tillage and Crop Production*. Scientific Publishers.
- Dhopte AM. 2002. *Agro Technology for Dryland Farming*. Scientific Publ.
- Gupta US. 1995. *Production and Improvements of Crops for Drylands.* Oxford & IBH
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MSWE104D – WATERSHED MANAGEMENT AND MODELLING

Course objective

To acquaint students with watershed management concept and its benefit forsustainable rural development through participatory approach, including environmental impact as well as policy frame work.

Unit I

Concept of watershed, its hydrological and geomorphological characteristics. **Status of watershed management programs in India. Problems of desertification and degradation for skill enhancement**

Unit II

Concept of watershed management and sustainability, participatory approach and operational watershed. Surveys, monitoring, reclamation and conservation of agricultural and forest watersheds, hill slopes and ravines **for skill enhancement**

Unit III

Watershed management research instrumentation and measurement, problem identification, simulation and synthesis. Rainfed farming and drought management. Modelling of flood and drought phenomenon **For better skilling of entrepreneurship**

Unit IV

Use of Remote Sensing and GIS in watershed management and modeling. Watershed modelling approaches, mathematical bases and structure of existing watershed models **for better employability in industry**

Unit V

Environmental impact assessment of watersheds. Quantitative evaluation of management techniques. National land use policy, legal and social aspects. Casestudies of watershed management. **For better skilling of entrepreneurship**

Outcome:

The students will be able to understand

CO1: different conservation practices **for skill enhancement**

CO2: conservation practices effect on watershed behaviour **for skill enhancement**

CO3: estimate the geomorphologic parameters of particular watershed which is quite useful for watershed planning. **For better skilling of entrepreneurship**

CO4: development of watershed models. **for better employability in industry**

CO5: Environmental impact assessment of watersheds. **For better skilling of entrepreneurship**

PO-CO Mapping (Please write 3, 2, 1 wherever required)

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Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	2	3	3	2	3	2	1	3
CO:2	3	2	3	3	3	3	2	3
CO:3	1	2	3	2	3	1	3	3
CO:4	3	3	1	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	3	1	2
CO:3	2	1	3
CO:4	1	3	2
CO:5	2	1	3

Suggested Books:

• Dhaliwal GS Hansra BS and Ladhar SS. 1993. *Wetlands, their Conservation and Management.* Punjab Agricultural University, Ludhiana.
• Dhruvanarayana VV, Sastry G and Patnaik US. *Watershed Management*. Publ. and Inf. Dv., ICAR, Krishi Anusandhan Bhavan, New Delhi.
• Singh RV. 2000. *Watershed Planning and Management*. Second Edition Yash Publishing House, Bikaner.

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MSWE104E - IRRIGATION ECONOMICS PLANNING AND MANAGEMENT

Course objective

To impart knowledge of various public and government policy on regulation and allocation of irrigation water, cost and benefit analysis including project evaluation, decision making process and risk analysis.

Unit I

Economic analysis. Problems in project selection. Methods and approaches to water pricing. Criteria for investment and pricing in irrigation projects. Social benefits, problems and causes of under-utilization. Mathematics of economic analysis. Cost allocation, separable and non-separable costs. Discounting factors and techniques. Determination of benefits, cost and benefit analysis. Project evaluation. Limitations of benefit-cost analysis. Dynamics of project analysis. for skill enhancement

Unit II

Role of financial analysis. Distinctions from economic analysis. Financial feasibility and analysis. Impact of public policies on regulation and allocation of irrigation water. Relative economic efficiency of alternative irrigation water management models. Irrigation system improvement by simulation and optimization to enhance irrigation water use efficiency. **for skill enhancement**

Unit III

Indian agriculture, main problems, population, government policies, systems, organizing agriculture production. Farm Management: Definition, importance, scope, relation with other sciences and its characteristics. **For better skilling of entrepreneurship**

Unit IV

Socio-economic survey. Importance of such survey in planning, implementation and evaluation of project performance. Planning of socio-economic survey, types of data sets to be collected, preparing the questionnaires form, schedules sampling, editing and scrutinizing of secondary data, classification and analysis of data. for better employability in industry

Unit V

Role of farm management principles in decision making for irrigated agriculture. Decision making process, assessing risk and uncertainty in planning. **For better skilling ofentrepreneurship**

Outcomes

The students will be able to

CO1: estimate the cost benefit analysis, pricing **for skill enhancement**

CO2: investment criteria on irrigation project evaluation **for skill enhancement**

CO3: finding their problems. . **For better skilling of entrepreneurship**

CO4: expose to conduct socio-economic survey **for better employability in industry**

CO5: analyse secondary data. . **For better skilling of entrepreneurship**

PO-CO Mapping (Please write 3, 2, 1 wherever required)

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Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	2	3	3	2	3	2	1	3
CO:2	3	2	3	3	3	3	2	3
CO:3	1	2	3	2	3	1	3	3
CO:4	3	3	1	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	3	1	2
CO:3	2	1	3
CO:4	1	3	2
CO:5	2	1	3

Suggested Reading

• Heady, Early Orel, Hexem R and Roger W. 1978. *Water Production Functions for IrrigatedAgriculture*.
• James Douglas and Lee Rober R. 1995. *Economics of Water Resource Planning*. Tata Mcgraw-Hill Publication Company Ltd, Bombay, New Delhi.
Joshi SS and TR Kapoor. 2001. *Fundamentals of Farm Business Management*. Kalyani Publishers, Ludhiana.

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MSWE203 A **Design of Farm Irrigation Systems** **L:T:P 3:0:0**

Objective

Principles of design creep theory – seepage force and safety against piping – inverted filter– uplift pressure – design considerations for protection works.

UNIT I

Concepts of Irrigation; Irrigation principles, losses, conveyance, distribution; Application, scheduling parameters, water budgeting **for skill enhancement**.

UNIT II

Surface irrigation, hydraulics of water advance and recession, hydraulic resistance to flow, gravity irrigation **for better skilling of entrepreneurship**.

UNIT III

Design of Border irrigation, furrow irrigation, check basin irrigation, Sub Irrigation methods and concepts **for better employability in industry**.

UNIT IV

Preliminary design criteria of sprinkler and micro irrigation systems, hydraulics of sprinkler and micro irrigation systems **methods for skilling of rescue management.**

UNIT V

Design of lateral, sub main and main line of sprinkler and micro irrigation. Fertigation aspects. Underground water conveyance system, Evaluation of irrigation systems and practices **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

CO1: Understand the concept irrigation and water budgeting **for skill enhancement**.

CO2: Know about the surface irrigation techniques **for better skilling of entrepreneurship**.

CO3: Develop knowledge about the different irrigation methods and its design criteria **for better employability in industry**.

CO4: Understand the micro-irrigation systems and its applications **methods for skilling of rescue management.**

CO5: Design the components of sprinkler and micro-irrigation systems and understand fertigation system **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	2	3	3	1	2	3
CO:2	1	3	1	1	3	3	1	2
CO:3	2	1	3	3	1	3	3	3
CO:4	3	2	1	3	2	3	3	1
CO:5	3	1	3	2	3	3	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	2
CO:2	3	1	3
CO:3	1	3	1
CO:4	3	2	2
CO:5	3	3	1

References:

1. Finkel HJ. 1983. Handbook of Irrigation Technology. Vols. I-II. CRC Press.
2. Peri G & Todes M. 1985. Irrigation Systems Design and Operation. Oxford Univ. Press.
3. Pillsbury AF. 1972. Sprinkler Irrigation. FAO Agricultural Development Paper No. 88, FAO.
4. Sivanappan RK. 1987. Sprinkler Irrigation. Oxford & IBH

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MSWE203 B **Flow through Porous Media** **L:T:P 3:0:0**

Objectives:

- Describe the physical nature and derive properties of porous media
- Describe flow dynamics in porous media
- Derive Darcy's Law
- Derive and manipulate equations governing saturated and unsaturated flows in porous media

UNIT I

Aquifer and fluid properties, Forces holding water in soils, Hydrodynamics in porous media and the limitations of the governing laws **for skill enhancement**.

UNIT II

Initial and boundary conditions, Dupuit and Boussinesque approximations and linearization techniques, stream and potential functions **for better skilling of entrepreneurship**.

UNIT III

Flow net and its use for subsurface flow quantification, Solutions of confined and unconfined flow problems **for better employability in industry**.

UNIT IV

Unsaturated flow theory and simulation of soil moisture dynamics, Analysis of seep-age from canals, Groundwater flow modeling, **methods for skilling of rescue management.**

UNIT V

Saline water-fresh water interface and interactions, Solute transport, Analysis and solution of groundwater flow problems **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

CO1: develop understanding of aquifer and its properties and hydrodynamics of porous media **for skill enhancement**.

CO2: Develop knowledge about Initial and boundary conditions of flow **for better skilling of entrepreneurship**.

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CO3: Understand the concept of flow net, confined and unconfined flows **for better employability in industry**.

CO4: Analyze about the seepage, unsaturated flow theory and simulation of soil moisture **methods for skilling of rescue management.**

CO5: Understand the Saline water-fresh water interface **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	2	1	3
CO:2	1	3	2	2	3	3	2	2
CO:3	3	1	3	1	3	3	3	3
CO:4	3	2	1	3	1	3	3	1
CO:5	3	1	3	2	3	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	3	1	3
CO:3	1	3	2
CO:4	3	1	2
CO:5	3	3	1

References:

1. Muskat, M. and Wyckoff, R.D. (1946). The Flow of Homogeneous Fluids through Po-rous Media. J.W. Edwards Inc. USA.
2. Polubarinova-Kochina, P.Ya. (1962). Theory of Ground Water Movement. PrincetonUniversity Press. USA.
3. Harr, Milton E. (1962). Groundwater and Seepage. Mc-Graw Hill Book Co. USA.
4. Remson I., Hornberger, G.M. and Molz Fred, J. (1971). Numerical Methods in Subsur-face Hydrology. Wiley-Interscience.
5. Beer, Jacob. (1972). Dynamics of Fluid Flow in Porous Media. American Elsevier, Amsterdam

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MSWE203C - DIMENTIONAL ANALYSIS AND SIMILITUDE

Course objective

To acquaint the students with importance of analysis of dimensions and similitude principles in structuring mathematical/simulation models of various processes underdifferent constraint variables.

Unit I

Introduction, Dimensions, Dimensional homogeneity, Non-dimensional parameter, Methods of dimensional analysis: Rayleigh's method, Buckingham-Pi theorem, Choice of variables, Model analysis, Examples on various applications, Dimensional analysis and Intermediate Asymptotic. for skill enhancement

Unit II

Model studies, Model classification, Dimensionless numbers: Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, Scale effects, Distorted models, Model laws. for better employability in industry

Unit III

Similitude: Types of similarities (geometric-kinematic and dynamic similarity), force ratios, similarity laws. Model analysis: Physical models. Similarity methods for nonlinear problem types of models, Scale effect. Numerical problems on Reynolds's and Froude's Model. For better skilling of entrepreneurship

Unit IV

Use and scope of mathematical modeling, Principles of model formulation, Role and importance of steady-state and dynamic simulation, for skill enhancement

Unit V

Classification of models, Model building, Modeling difficulties, Degree-of-freedom analysis, Selection of design . **For better skilling of entrepreneurship**

Outcomes:

The students will be able to
CO1: analyze complex problems using dimensional analysis
CO2: develop rules for experiments with scale models
CO3: provide basis for analyses and calculations, including simplifications and assumptions made, when formulating mathematical models.
CO4: mathematical modeling
CO5: Modeling difficulties

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8

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CO:1	3	2	3	2	3	2	1	3
CO:2	3	1	1	3	3	3	2	3
CO:3	1	2	3	3	3	1	3	3
CO:4	3	3	1	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	**Employability**	**Entrepreneurship Development**
CO:1	3	2	1
CO:2	1	3	2
CO:3	2	1	3
CO:4	3	1	2
CO:5	2	1	3

Suggested Books:

- Barenblatt GI. 1987. *Dimensional Analysis*. Gordon and Breach Science, New York.
- Langhar HL. 1951. *Dimensional Analysis and the Theory of Models*. Wiley, New York.
- Murphy G. 1950. *Similitude in Engineering*. The Ronald Press Company, New York.
- Zohuri Bahman. *Dimensional Analysis and Self-Similarity Methods for Engineers andScientists*. Springer Publications, New York.

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MSWE203D - COMMAND AREA MANAGEMENT

Course Objective

To acquaint students about the concept of command area management, assessment and appraisal of water availability in command areas, water management problemsin command areas and their possible remedies including socio-economic aspects ofirrigation command.

Unit I

Concept of command area development as an integrated approach. Command areaproject formulation, major, medium and minor projects. Command areas in India,command area activities and their prioritization. Source of budget for CAD works. Structure of command area development, organization, role and responsibilities ofCADA. **for skill enhancement**

Unit II

Laser based land grading survey and levelling in command areas. Design of lined and unlined canals. Diversion head works and canal head regulators, cross drainageworks, canal falls, canal breaches. Design of On Farm Water Distribution Network, operation and maintenance of canal. **for skill enhancement**

Unit III

Assessment and appraisal of water availability in command areas. Water management problems in command areas and their possible remedies. Duty ofwater, its determination and factors affecting it. Methods of improving duty of canal water. Feasibility of drip irrigation in irrigated command areas. **For better skilling of entrepreneurship in industry**

Unit IV

Single and multi-objective command area planning for the better management and allocation of irrigation water. Conjunctive use of canal water and groundwater. Real time canal irrigation scheduling. **for better employability in industry**

Unit V

Canal performance indices. Diagnostic analysis and perform appraisal of command area projects. Water user's association–functions, problems encountered during formation of WUA and strategy and overcome the problems. Participatory irrigationmanagement efforts and strategy for preparing PIM. Socio economic aspects of irrigation management in command areas. **For better skilling of entrepreneurship**

Outcomes

The students will be able to understand the
CO1: concept of command area
CO2: management of command area,
CO3: analyze problem diagnostics and
CO4: remedies of command area and
CO5: performance evaluation procedure of command area.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	2	3	3	2	3	2	1	3
CO:2	3	2	3	3	3	3	2	3
CO:3	1	2	3	2	3	1	3	3
CO:4	3	3	1	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	3	1	2
CO:3	2	1	3
CO:4	1	3	2
CO:5	2	1	3

Suggested Reading

- Jos´eLiria Montanes. 2006. *Design, Construction, Regulation and Maintenance.* Taylor andFrancis Publication.
- Modi PN. *Irrigation Water Resources and Water Power Engineering.* Standard Publishers.
- Singh VP. 2014. *Entropy Theory in Hydraulic Engineering: An Introduction.* ASCE Press.
- Sharma SK. *Irrigation Water Resources and Water Power Engineering.* Standard Publishers.

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MSWE203E - WATER RESOURCES SYSTEMS ENGINEERING

Course Objective

To acquaint students about the concept of optimization and its application in waterresources management, mathematical programming techniques and multi objective water resources planning.

Unit I

Concepts and significance of optimization in water resources management. Model development in water management. Objective functions, deterministic and stochasticinputs. **For better skilling of entrepreneurship**

Unit II

Soil plant atmosphere system. Problem formulation. Mathematical programming techniques: Linear programming, simplex method. **for better employability in industry**

Unit III

Non-linear programming, quadratic programming, integer programming. Transportation problem and solution procedure. Geometric programming and dynamic programming. **For better skilling of entrepreneurship**

Unit IV

Application of optimization techniques for water resources planning. Conjunctive use of water resources. Crop production functions and irrigation optimization **for skill enhancement**

Unit V

Multi objective water resources planning. Critical path method. Programmeevaluation and review technique. Economic models. Project evaluation anddiscounting methods **for skill enhancement**

Outcomes

The students will be able to identify

CO1: objective function and components in water resource planning problems **For betterskilling of entrepreneurship**

CO2: formulate various mathematical programming models and **for better employability inindustry**

CO3: solve various mathematical programming models of water resource system **For betterskilling of entrepreneurship**

CO4: develop conjunctive use and . **for skill enhancement**

CO5: crop production function optimization models. . **for skill enhancement**

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	2	3	3	2	2	3	1	3
CO:2	3	2	3	3	3	3	2	3
CO:3	1	2	3	2	3	2	3	3
CO:4	3	3	2	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	1	2	3
CO:2	1	2	2
CO:3	2	1	3
CO:4	3	1	2
CO:5	3	1	2

Suggested Books

- Larry WM. 1996. *Water Resources Handbook.* Mc-Graw-Hill.
- Loucks DP *et al*. 1981. *Water Resources System Planning and Analysis.* Prentice Hall.
- Rao SS. 1978. *Optimization Theory and Application*. Wiley Eastern.

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MSWE 303 I **Crop Environmental Engineering** **L:T:P 3:0:0**

Objectives

- To familiarize the students with various water treatment and sanitary engineering principles and applications.
- To understand the natural environment and its relationships with human activities andtocharacterize and analyze human impacts on the environment.

UNIT I

Aerial and edaphic environments for plant growth, energy and mass transfer in and above crop canopiesb **for skill enhancement**.

UNIT II

Climatic changes and plant response to environmental stresses, evapotranspiration models. Instrumentation and techniques for monitoring plant environments **for better skilling of entrepreneurship**.

UNIT III

Processes and aspects of growth and development, soil-root interface, root sink functions **for better employability in industry**.

UNIT IV

Water movement in soil-plant atmosphere continuum, artificial environments and plant behavior **methods for skilling of rescue management.**

UNIT V

Design and operation of controlled environment facilities and their instrumentation. Crop growth and yield modeling **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

CO1: To develop the common understanding aerial and edaphic environments for plant growth **for skill enhancement**.

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CO2: Understand the response of plant to climate change and required techniques for monitoring plant environment **for better skilling of entrepreneurship**.

CO3: analyze the growth and development measures in plants **for better employability in industry**.

CO4: understand the scenario of Water movement in soil-plant atmosphere **methods for skilling of rescue management.**

CO5: understand the design and operation of controlled environment facilities, crop growth and yield modeling **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	2	3	3	1	2	3
CO:2	3	3	1	2	1	3	1	2
CO:3	1	2	3	1	2	3	3	3
CO:4	3	1	2	3	1	3	3	1
CO:5	3	2	3	2	3	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	3	1	3
CO:3	2	3	2
CO:4	3	1	2
CO:5	3	3	1

References:

1. Ghildyal BP & Tripathy RP. 1987. Fundamental of Soil Physics. Wiley Eastern.
2. Slatyor OP. 1967. Plant Water Relationship. Academic Press.
3. McMahon, Margaret E., Kofra., Plant science growth: Growth, Development and utilization, ISBN
4. **Website Source:**

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MSWE 303 II Design of Surface Irrigation System L:T:P 3:0:0

Objectives

- Irrigation systems principles and design procedures for design and operation of sprinkler, trickle, and surface irrigation systems.
- To introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management
- The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part.
- To develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects.

UNIT I

Historical evidence of development and progress of farm irrigation systems, Land irritability, Theory of Infiltration and its measurement **for skill enhancement**.

UNIT II

Methods of irrigation - their suitability and limitations, Water advance and recession in surface irrigation **for better skilling of entrepreneurship**.

UNIT III

Design of surface irrigation systems, Surge irrigation and its design, Irrigation water quality, Leaching requirement of salt affected soils, Use of saline water for irrigation **for better employability in industry**.

UNIT IV

Irrigation scheduling and equity in water distribution, optimal layout of conveyance network- shortest route and minimum spanning tree options **methods for skilling of rescue management.**

UNIT V

L-sectioning of water conveyance network, Channel lining to control seepage loss and its economics, Environmental impact of irrigation projects, Case studies **for skill development and employability**.

Course Outcomes:

At the end of this course, the student will be able to

CO1: Understand the historical farm irrigation systems and their measurement **for skill enhancement.**

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CO2: understand the different surface irrigation methods **for better skilling of entrepreneurship**.

CO3: design the surface irrigation systems and measure the irrigation water quality **for better employability in industry**.

CO4: understand the Irrigation scheduling and water distribution system.

CO5: analyze the water conveyance network, channel lining and understand the environmental impacts of irrigation projects **for skill development and employability**.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	3	1	3	3	1	2	3
CO:2	1	3	2	1	2	3	1	2
CO:3	3	1	3	2	1	2	1	3
CO:4	2	1	3	3	2	3	3	1
CO:5	3	2	3	1	3	3	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	1	2
CO:2	3	2	3
CO:3	1	3	1
CO:4	2	1	2
CO:5	3	3	1

References:

1. Michael, A.M. Irrigation Theory and Practice. Vikas Publ. New Delhi.
2. Jensen, M.E. (Editor). (1983). Design and Operation of Farm Irrigation Systems. ASAE
3. Monograph No. 3. USA.
4. Walker, W.R. and G.V. Skogerboe. (1987). Surface Irrigation: Theory and Practice..
5. Withers, Bruce and Vipond, Stanley. (1974). Irrigation: Design and Practice. B.T. Batsford.

Website Source:

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MSWE303C - WASTE WATER MANAGEMENT AND UTILIZATION

Course Objective

To acquaint students about status of waste water and water quality requirements,standards both for domestic and irrigation purposes and also to provide in depth knowledge of waste water treatment methods and utilization in agriculture.

Unit I

Status of wastewater in India. Sources of contamination and characterization of urban and rural wastewater for irrigation. Water quality: Physical, chemical andbiological parameters of wastewater. **for skill enhancement**

Unit II

Water quality requirement: Potable water standards, wastewater effluent standards, water quality indices. Irrigation water quality standards and guidelines for their restricted and unrestricted uses. Selection of appropriate forestry trees, fruits, vegetables, oilseeds and food grain crop for wastewater utilization. **for better employability inindustry**

Unit III

Control measures for preventing soil and other surface/groundwater source contamination. Different types of wastewater, pollutants and contaminants. Impact of wastewater on ecosystem eutrophication, biomagnification, water borne diseases. **For betterskilling of entrepreneurship**

Unit IV

Wastewater treatment methods: Physical, chemical and biological. General water treatments: Wastewater recycling, constructed wetlands, reed bed system. Carbonfoot prints of wastewater reuse. Environmental standards. **for skill enhancement**

Unit V

Regulation and environmental impact assessment (EIA): Environmental standards- CPCB Norms for discharging industrial effluents to public sewers. Stages of EIA Monitoring and Auditing. Environmental clearance procedure in India. **for better employability in industry**

Outcomes:

The students will be able to understand

CO1: sources and treatment methods of waste water quality. **for skill enhancement**

CO2: standard norms of water quality for domestic and irrigation . **for better employability in industry**

CO3: waste water recycling **For better skilling of entrepreneurship**

CO4: environmental standards. **for skill enhancement**

CO5: environmental impact assessment **for better employability in industry PO-CO Mapping**
(Please write 3, 2, 1 wherever required)

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Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	3	2	3	2	3	2	1	3
CO:2	3	1	2	3	3	3	2	3
CO:3	1	2	3	3	3	1	2	3
CO:4	3	3	3	3	2	2	3	2
CO:5	3	2	1	3	2	2	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO:1	3	2	1
CO:2	1	3	2
CO:3	2	1	3
CO:4	3	1	2
CO:5	2	3	1

Suggested Books:

• Charis Michel Galanakis. *Sustainable Water and Wastewater Processing.* Elsevier Publication, Amsterdam.
• Sean X Liu. 2014. *Food and Agricultural Wastewater Utilization and Treatment.* Wileu Blackwell New York.
Shirish H, Sonawane Y, Pydi Setty T, Bala Narsaiah and S Srinu Naik. 2017. *Innovative Technologies for the Treatment of Industrial Wastewater: A Sustainable Approach.* CRC Press

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MSWE303D – SENSING AND AUTOMATION IN IRRIGATION SYSTEM

Course objective

To acquaint students about the concept of sensing and automation in irrigation system, wireless sensor network and digital signal processor. To provide knowledgeof surface irrigation automation.

Unit I

Sensing and sensors. Sensor classifications. Wireless sensor networks. History of wireless sensor networks (WSN). Communication in a WSN. Important design constraints of a WSN like Energy, self management, wireless networking, decentralized management, design constraints, security etc. **for skill enhancement**

Unit II

Node architecture. Sensing subsystem. Analog-to-Digital converter. **for skill enhancement**

Unit III

The processor subsystem, architectural overview, microcontroller, digital signal processor, application-specific integrated circuit, field programmable gate array (FPGA). **For betterskilling of entrepreneurship**

Unit IV

Communication interfaces, serial peripheral interface, inter-integrated circuit, the IMote node architecture, The XYZ node architecture, the Hogthrob node architecture. **For better skilling of entrepreneurship**

Unit -V

Applications in surface irrigation automation, automation based on volume, time, fertigation scheduling, water logging, salinity, oxygen diffusion systems, etc. **for better employability in industry**

Outcomes

The students will be able to understand

CO1: Concept of automation in irrigation system. **for skill enhancement**

CO2: Importance of water use efficiency in irrigation. **for skill enhancement**

CO3: Applications in surface irrigation automation. **For better skilling of entrepreneurship**

CO4: Node architecture and . **For better skilling of entrepreneurship**

CO5: other routing protocols. **for better employability in industry**

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8

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CO:1	2	3	3	2	3	2	1	3
CO:2	3	2	3	3	3	3	2	3
CO:3	1	2	3	2	3	1	3	3
CO:4	3	3	1	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	**Employability**	**Entrepreneurship Development**
CO:1	3	2	1
CO:2	3	1	2
CO:3	2	1	3
CO:4	1	2	3
CO:5	2	3	1

Suggested books:

- Cauligi S Raghavendra, Krishna M Sivalingam and Taieb Znati. *Wireless SensorNetworks*.Springer.
- Edgar H, Callaway Jr. and Edgar H Callaway. *Wireless Sensor Networks: Architecturesand Protocols*.
- Holger Karl and Andreas Willig. *Protocols and Architectures for Wireless SensorNetworks*. John Wiley & Sons.

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MSWE303E - MINOR IRRIGATION TECHNIQUES

Course Objective

To acquaint students about the need and scope of minor irrigation in India. To provide in depth knowledge in design and operation of surface and ground water based irrigation practices.

Unit I

Definition, scope, historical background and progress in minor irrigation works in India, Assessment of surface water resource. Design and operation of surface water storage structures. **For better skilling of entrepreneurship**

Unit II

Evaporation and seepage control. Groundwater development methods and their scope. Groundwater extraction devices and methods. Aquifer characteristic and their evaluation. Wells in alluvial and rocky aquifers. **for better employability in industry**

Unit III

Well interference, spacing and multiple well point system for controlled groundwater pumping. Safe yield from wells. Augmentation of well yield through pumping and recovery time management. **for skill enhancement**

Unit IV

Well design, drilling and construction. Tube well strainers, gravel packing and resistance to flow. Pumps and prime movers for groundwater lifting. Diagnosis ofsick and failed wells and their remediation. **for skill enhancement**

Unit V

Conjunctive use of surface and groundwater. Legislation for groundwater development and management. Groundwater recharge and its use **for skill enhancement**

Outcomes

The students will be able to
CO1: understand minor irrigation practices **For better skilling of entrepreneurship**

CO2: minor irrigation practices importance in Indian agriculture **for better employability inindustry**

CO3: conjunctive use of surface and groundwater **for skill enhancement**

CO4: perform groundwater development legislation, **for skill enhancement**CO5: recharge and utilization practices **for skill enhancement**

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO:1	2	3	3	2	3	2	1	3

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CO:2	3	2	3	3	3	3	2	3
CO:3	1	2	3	2	3	1	3	3
CO:4	3	3	1	3	2	1	3	2
CO:5	3	2	1	3	2	1	2	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	**Employability**	**Entrepreneurship Development**
CO:1	1	2	3
CO:2	1	3	2
CO:3	3	1	2
CO:4	3	1	2
CO:5	3	1	2

Suggested Books

• Garg SK. 1987. *Irrigation Engineering and Hydraulic Structures*. Khanna Publisher, Delhi. Garg SK. 1987. *Hydrology and Water*

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